

Visibility Monitoring



United States
Department of
Agriculture
Forest Service
Air Program

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Background

The Clean Air Act assigns the USDA Forest Service an affirmative responsibility to protect and improve visibility in eighty-eight Wildernesses. The National Park Service and US Fish and Wildlife Service have similar responsibilities for parks and refuges. To fulfill these responsibilities, Federal Land Managers have established a professional visibility monitoring program in coordination with the US Environmental Protection Agency and many state agencies. Monitoring data are used to assess visibility conditions and trends and to create emissions management strategies. All 50 states are now writing strategies for review by Federal Land Managers and 2007 approval by the US Environmental Protection Agency. As state plans are implemented, the Interagency Monitoring of Protected Visual Environments (IMPROVE) visibility monitoring network will document progress towards the national visibility goal: to attain natural background visibility conditions in all Class I areas by 2064.

Visibility Monitoring Equipment and Sites

A fully-equipped IMPROVE monitoring site has:

- **Aerosol samplers (Fig 1)** to capture particles that scatter or absorb light. Lost visual acuity, coloration, and fidelity when viewing a distant object are estimated from types and amounts of these particles. The aerosol sampler is most useful for designing emissions reductions programs and controls needed to improve visibility because it identifies likely sources of haze and source locations. A 24-hour sample is collected every third day and mailed weekly to the Crocker Nuclear Laboratory at the University of California in Davis by Forest Service technicians or contractors.
- **Cameras (Fig 2)** to make high resolution images of distant viewpoints. Cameras, or scene monitors, are most useful for documenting the range of visibility conditions and, together with optical and aerosol data, aid the decision-maker in understanding changes in visibility conditions. With help from scientists and specialists, policy-makers can use these data to design control strategies to meet visibility objectives.
- **Optical equipment (Figs 3 & 4)** to accurately measure light extinction. Optical data corroborate



Fig 1. The IMPROVE Modular Aerosol Sampler measures fine and total aerosol mass. The sampler was developed by the IMPROVE program, operating since 1987.



Fig 2. Scene Monitoring System digital camera. Some cameras are live on the web – some data have to be manually retrieved.



Fig 3. The Optec LPV-2 transmissometer measures light attenuation from a source.



Fig 4. Integrating nephelometers measure light scattering.

aerosol sampler results and provide continuous visibility data.

All Forest Service Scene data from 75 sites dating to the early 1980's are viewable online (**Fig 5**).

Partnerships and Funding

IMPROVE is a complex, efficient partnership of ~170 sites nationwide; 110 sites administered by Federal Land Managers. The US Environmental Protection Agency pays for the capital and analytical costs of most aerosol samplers at the Forest Service sites. The Forest Service funds the cameras and Scenes website, some aerosol samplers and optical devices, and a full-time visibility data analyst to help Forest Service staff and contractors properly interpret and use the data. Nearly all operators

are Forest Service staff. Annual operator costs borne by Forest Service field units are \$2,500 to \$36,000, depending on site accessibility. The National Park Service invests heavily in visibility research to interpret IMPROVE data. Air Program staff work closely with them to maximize benefits from the available science.

The US Environmental Protection Agency establishes rules by which states work with Federal Land Managers to manage visibility data and ensure that Federal Land Manager visibility objectives for Class I areas are met, and can impose sanctions if this does not happen. The Forest Service contributes substantial technical expertise

to states to obtain, interpret and use available data to best advantage for Class I areas protection.

Within the agency, Forest Service visibility monitoring is funded by a streamlined process that collects funds from each Region. Without this, Region or Forests would bear the expense of arranging contractual services and agreements, substantially compounding overhead and risking national consistency. The Rocky Mountain Research Station arranges centralized national contracts and agreements to accomplish this work and other Air Program efforts like IMPROVE and the highly successful Wildland Smoke Monitoring Program and website.

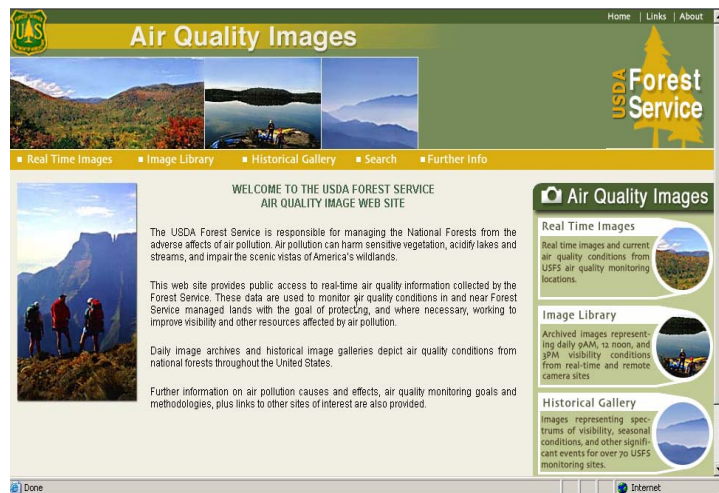


Fig 5. Forest Service Scene Monitoring Website. This site features real-time webcam images from Class I areas and historical scene data from most Forest Service Class I areas. Go to: <http://www.fsvisimages.com>